Review of: "Qualitative Analysis of a Time-Delay Transmission Model for COVID-19 Based on Susceptible Populations With Basic Medical History"

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Potential competing interests: No potential competing interests to declare.

This paper proposes a SEIR-type model for COVID-19 epidemic propagation in which a time delay is introduced in the equations. The idea is to model the time from getting in contact with the virus to become infected by means of a time delay in the equation of the infected population, instead of using the “exposed” group of population.

I find some important drawbaks in the paper:

- First, the model includes the incorporation of new individuals (new born for example) and the dead of individuals by non-covid causes. This is convenient if you are considering the endemic state for example. My concern is how the icorporation of new individuals is modelled. It is assumed that new individuals appear in a constat ratio (A coefficient in the first equation), which is not realistic. It is well accepted that the population grows with a ratio proportional to the total population, If N is the total population (non-infected, infected and recovered individuals), then instead of A, the first equation should contain a term A N. This has been studied for example in “Modified SEIR epidemic model including asymptomatic and hospitalized cases, with correct demographic evolution”, Applied Mathematics and Computation, 456, 128122.
- The authors should compare the results (equilibrium points, behaviour of the solutions) of the new model with respect the previous model without time delay, showing that the new model can reproduce better the real behaviour of the propagation of the epidemic. If this is not the case, there is no sense in complicating the model.
- The proof of Theorem 7 is not clear to me. It should be proved that the Lyapunov function L_2 is positive. Otherwise, if at some time L_2 <0, since its total derivative is negative, L_2 would never be zero, and the solution could not tend to the equilibrium point.
- The numerical experiments should confirm the results presented in the paper. For example, it should be shown that the solution tends to the proper equilibrium point (in agreement with the stability results).